

DERC PROPOSAL ON NET METERING & CONNECTIVITY IN RESPECT OF ROOFTOP SOLAR PV PROJECTS

1. **Introduction:** - Delhi has about 250 to 300 sunny days available and average solar installation of 5.31 KWhr/day/sq.mtr. Delhi has around 30 lakh households and about 12 lakh commercial, industrial and other consumers. Delhi State has more than 700 Sq. Kms. Of built-up area for the installation of PV systems. Setting up of large solar power projects requires huge land space whereas availability of land is a major constraint in Delhi. The prevailing scenario of declining trend in solar tariff and increasing retail tariff across most consumer categories like residential, commercial and industrial consumers would encourage consumers to install roof top solar systems. . Therefore, roof top solar is set to witness appreciable scaling of capacities in Delhi.

Keeping the model regulation issued by the FOR, the Commission has decided to issue this proposal on NET-metering and LT connectivity for inviting comments/suggestions from stakeholders.

- 2.0 **Net-metering:** The net metering based rooftop solar projects facilitates the self-consumption of electricity generating by the rooftop project and allows for feeding the surplus into the network of the distribution licensee. The type of ownership structure for installation of such net metering based rooftop solar systems becomes an important parameter for defining the different rooftop solar models. In the international context, the rooftop solar projects have two distinct ownership arrangements.

- Self-owned arrangement wherein rooftop owner also owns the PV system.
- Third party ownership in which a developer owns the PV system and also enters into a lease/commercial arrangement with the rooftop owner.

Both these models are relevant in Delhi context as defined below:-

- 2.1 **Self-owned, net metering based rooftop PV:** In a self owned, net metering based rooftop PV model, the rooftop owner, who is also the electricity consumer for the utility installs the rooftop solar system, either on its own or with the help of a system supplier and installer. The electricity generated by the system is first used to service consumer's captive load within the rooftop owner's premises. The solar power generated in excess of the owner's electricity consumption is fed into the grid through a net-meter, which is a bi-directional energy meter capable of registering both import and export of electricity. This net generation is then credited to the owner's account and adjusted subsequently against imports from the grid.

- 2.2 **Third party owned Rooftop PV net metering model:** In the third party owned rooftop PV net metering model, the developers or intermediaries lease out solar PV systems to interested rooftop owners. This can be a popular model for residential home owners, where turnkey installers lease rooftop systems to individual owners who, in turn, pay them a monthly lease rental. The owner of the house provides the rooftop and commissions a turnkey installer to design and install the system. Alternatively, the installers can also offer an integrated service of leasing, commissioning and maintaining

the systems to owners and guaranteeing standards of performance. The electricity generated from such a system is used to meet the rooftop owner's internal electricity needs while the excess generation is fed into the grid on net metering basis. This model has the following benefits.

- Benefits to rooftop owner: The household owner avoids large upfront investment for the solar equipment and on occasion avoids assuming technology or performance risk of solar systems. Net metering allows the rooftop owner to save on power consumed from the grid to the extent of solar generation. A part of savings in power consumption is shared with the developer by way of a lease rental.
- Benefits to developer: The leasing company generates revenues by way of lease rental from the rooftop owner under a contract. As it continues to be owner of the equipment, it also qualifies for claiming depreciation on the capital cost of the PV systems with associated direct tax benefits.

However, a third party owned system, would result in an open access transaction with implications of wheeling charges and surcharge relating to cross subsidy.

3.0 Net-metering :

The distribution licensee shall allow non-discriminatory net-metering arrangement on first-cm-first serve basis for both self-owned and third party owned rooftop PV systems as long as the total capacity (in MW) does not exceed the target capacity determined by the Commission as given in Clause 3.4.

3.1 Interconnection arrangements:

Net-metering facility shall be extended to the solar power system installed in establishments /consumers connected to the electrical grid. These consumers are the "eligible consumers" for the purpose of net-metering. Interconnection framework for net-metering shall address parameters including connecting voltage level, any minimum technical standards for interconnection as indicated by the Commission in DRC (Terms & Conditions for Determination of Tariff for Grid Connected Solar Photo Voltaic Project) Regulations, 2013 and Delhi Electricity Supply Code, 2007 and as per technical standards for Connectivity of Distributed Generation resources Regulations 2013 notified by Central Electricity Authority.

3.2 Capacity Limits

The capacity of an individual rooftop PV system would be the available capacity of the service line connection, i.e. the sanctioned load of the consumer. The installation of net-metered rooftop solar systems on consumer premises will utilize the same service line for excess power injection into the Grid which is currently being used by the consumer for drawl of power from utility network. If a higher capacity than the sanctioned load of the consumer is installed, then the consumer would have to pay SLD charges as prescribed in the DERC Supply Code & Performance Standards, 2007 for installation of new service line and related infrastructure.

3.3 Application:

The consumer shall make an application in the prescribed format to the DISCOM along with a fee of Rs.1000/- (Rupees Thousand). The consumer can download the solar net-metering rooftop application form from the website of the DISCOMs. Permission will be normally issued within 15 days from the date of submission of the application to the DISCOM provided there is feasibility for connectivity.

3.4 Restrictions on level of overall or local grid penetration

Net-metering based rooftop solar systems are small capacity systems and can be expected to proliferate fast when the policy and regulations are conducive. The impact and level of proliferation of net-metering based rooftop would have an impact on the local grid which has to address technical, safety and grid security issues arising out of possible reverse flow of electricity in the local grids. The distribution licensee shall provide net metering arrangement to all eligible consumers as long as the cumulative capacity to be allowed for a particular distribution transformer shall not exceed 15% of the capacity of the distribution transformer.

The distribution utility to which the latter category of consumers are connected can be given the benefit of deemed RPO self-consumption of electricity by consumers who are not defined as obligated entities under the RPO framework. This will encourage utilities to facilitate implementation of small capacity net-metering based rooftop solar projects. The quantum of electricity consumed by an eligible consumer, who is not defined as an obligated entity from the rooftop solar system under net-metering arrangement shall qualify as deemed Renewable Purchase Obligation (RPO) for the distribution licensee.

4. Metering:

- (i) Two meters would have to be installed by the solar power generator. One is for measuring solar generation and the other is for Import/Export measurement. The first meter, the solar generation meter, has to be installed at the generator end after the inverter at the ground floor of the premises to facilitate easy access for meter reading. The point of solar power injection may be in between the load and the Import/Export (Bi- directional) meter. The second meter is a bi-directional meter (single phase or three phase as per requirement) and be accepted for commercial settlements. These meters should be MRI and AMR compliant. If the consumer wishes to have a record of the reading taken, he shall be allowed to do so by the licensee. This meter will replace the existing consumer meter. The first and the second meter have to be installed at the same location where the present meter for consumption is installed. The cost of these meters shall be borne by the consumer.

For connectivity at 11 kV level, the HT bi-directional meters with harmonic measurement provision available shall be provided. Net-metering meter configuration options with and without storage is furnished in Annexure- I (a) and 1(b).

- (ii) The meters shall adhere to the standards for consumers specified by the Authority in CEA Regulations on Installation and Operation of meters Regulations, 2006 and (Installation and Operation of meters) Amendment Regulations, 2010 as amended from time to time. The Solar Generation Meter shall be of 0.2s class accuracy. The additional standards for single phase and three phase bi-directional energy meters are furnished in Annexure - II. The Solar check meters shall be mandatory for rooftop solar installations having capacity of more than 20 KW. For installations size of less than and equal to 20 KW, the solar check meters would be optional. The cost of new/additional meter(s) provided for the net-metering and the installation and testing charges shall be borne by the eligible consumers. The Distribution Licensee shall procure, test and install the meters. The eligible consumers may procure the meters as per the relevant standards. Position & sealing of meters will be guided by the same provisions as applicable to consumer meter in Distribution/Supply Code. The meters installed shall be jointly inspected and sealed on behalf of both the parties. In case, the eligible consumer is under the ambit of time of day tariff, meters will be compliant for recording the time of day consumption and generation.

(ii) Energy Accounting:

Electricity generated from a solar rooftop system shall be capped cumulatively at 90% of the electricity consumption by the eligible consumer at the end of settlement period which shall be the relevant financial year. In case of COD during the year, the 90% capping shall be on the energy drawl by the consumer from the date of COD to the end of the financial year. The carry forward of excess energy generation will be allowed from one billing cycle to the next billing cycle up-till the end of the same financial year and above capping shall apply therein to allow for seasonality in generation. **Any excess generation (above 90 per cent) at the end of the financial year would be considered as free energy and not offset against the consumer's consumption. There shall be no carry forward to next financial year.**

(iii) Billing and Payment

The consumer shall receive a net import/export bill indicating either net export to the Grid or net import from the Grid.

In case of net import bill, i.e. electricity supplied by the distribution licensee exceeds the electricity generated by the eligible consumers solar rooftop system, the distribution licensee shall raise invoice for the net electricity consumption after taking into account any carry forward from previous billing periods in the same financial year.

The consumer shall settle the same as per existing norms. If it is a net export bill, then credit amount shall be carried forward to next month for adjustment against next month's import bill. No interest will be payable on this credit forward amount. Net credit available in account of the consumer

will be finally adjusted in April of the next year, subject to the cap stated above.

If the eligible consumer is under the ambit of time of day tariff, the electricity consumption in any time block peak, off-peak or normal shall be first set off with the solar generation in the same time block. Any excess generation over consumption in any time block, over and above the usage in that time block shall be adjusted at the lowest applicable tariff across all the slots. This will safeguard the interest of the utility.

4.0 LT Connectivity

(i) Capacity Limits & Interconnection Voltage

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply code and amended from time to time. The interconnecting voltage level of the SPGs for various capacity ranges shall be as follows:

Capacity range	Connecting voltage
Upto 10 kW	240V-single phase or 415V-three phase at the option of the consumer
Above 10kW and upto 100 kW	415V – three phase
Above 100kW	At HT/EHT level

The maximum permissible capacity for rooftop shall be 1 MW for a single net-metering point.

(ii) Important clauses related to the technical and interconnection requirements are provided below:-

Parameter	Reference	Requirement
Overall conditions of service	State Distribution/Supply Code	Reference to State Distribution Code
Overall Grid Standards	Central Electricity Authority(Grid Standard) Regulations 2010	Reference to regulations
Equipment	BIS / IEC / IEEE	Reference to standards
Meters	Central Electricity authority (Installation & operation of meters) Regulation 2006	Reference to regulations and additional conditions issued by the Commission.
Safety and supply	Central Electricity Authority(measures of safety and electricity supply) Regulations,2010	Reference to regulations
Harmonic Requirements		
Harmonic Current	IEEE 519	Harmonic current

	CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	injections from a generating station shall not exceed the limits specified in IEEE 519
Synchronization	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Photovoltaic system must be equipped with a grid frequency synchronization device. Every time the generating station is synchronized to the electricity system. It shall not cause voltage fluctuation greater than +/- 5% at point of connection.
Voltage	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. Beyond a clearing time of 2 second, the photovoltaic system must isolate itself from the grid.
Flicker	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Operation of Photovoltaic system should not cause voltage flicker in excess of the limits stated in IEC 61000 standards or other equivalent Indian standards, if any.
Frequency	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	When the Distribution system frequency deviates outside the specified conditions (50.5 Hz on upper side and 47.5 Hz on lower side), There should be over and under frequency trip functions with a clearing time of 0.2 seconds.

DC injection	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point or 1% of rated inverter output current into distribution system under any operating conditions.
Power Factor	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	While the output of the inverter is greater than 50%, a lagging power factor of greater than 0.9 should operate.
Islanding and Disconnection	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The photovoltaic system in the event of fault, voltage or frequency variations must island/disconnect itself within IEC standard on stipulated period.
Overload and Overheat	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	The inverter should have the facility to automatically switch off in case of overload or overheating and should restart when normal conditions are restored.
Paralleling Device	IEEE 519 CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013	Paralleling device of photovoltaic system shall be capable of withstanding 220% of the normal voltage at the interconnection point.

(iv) Operation and Maintenance

1. The solar plant shall comply with the relevant standards specified by the MNRE /BIS and CEA. The responsibility of operation and maintenance of the solar photo voltaic (SPV) generator including all accessories and apparatus lies with the consumer. The design and installation of the rooftop SPV should be equipped with appropriately rated protective devices to sense any abnormality in the system and carry out automatic isolation of the SPV from the grid. The inverters used should meet the necessary quality requirements and should be

certified for their quality by appropriate authority; the protection logics should be tested before commissioning of the plant. Safety certificates for the installations should be obtained from the appropriate authorities.

2. The automatic isolation or islanding protection of SPV should be ensured for, no grid supply and low or over voltage conditions and within the required response time. Adequate rated fuses and fast acting circuit breakers on input and output side of the inverters and disconnect/isolating switches to isolate DC and AC system for maintenance shall be provided. The consumer should provide for all internal safety and protective mechanism for earthing, surge, DC ground fault, transients etc.
3. To prevent back feeding and possible accidents when maintenance works are carried out by DISCOM personnel, Double pole/Triple pole isolating disconnect switches which can be locked by DISCOM personnel should be provide. This is in addition to automatic sensing and isolating on grid supply failure etc and in additional internal disconnect switches. In the event of DISCOM LT supply failure, the promoter has to ensure that there will not be any solar power being fed to the IT grid of DISCOM. The consumer is solely responsible for any accident to human beings/animals whatsoever (fatal/non fatal/departamental/non departamental) that may occur due to back feeding from the SPV plant when the grid supply is off. DISCOM reserves the right to disconnect the installation at any time in the event of damage to its grid, meter, etc. or to prevent accident or damage.
4. The consumer shall abide by all the codes and regulations issued by the Commission to the extent applicable and in force from time to time. The consumer shall comply with DERC/DISCOM/CEA requirements with respect to safe, secure and reliable function of the SPV plant and the grid. The power injected into the grid shall be of the required quality in respect of wave shape, frequency, absence of DC components etc.
5. The SPG shall restrict the harmonic generation within the limit specified in the agreement or specified by the Central Electricity Authority as and when such regulation is issued.
6. The SPG (individual homes/commercial establishments) may establish LT grid interactive solar power plant in the roof top or surface level with the following options:
 1. Grid interactive solar PV system without battery.
 2. Grid interactive solar PV system with battery back up.

When the consumer prefers LT connectivity without battery backup (full load backup/partial load backup), the inverter shall have separate backup wiring to prevent the battery/DG power to flowing into the

grid in the absence of grid supply and manual isolation switch shall also be provided. The manual isolation switch shall have locking facilities to enable DISCOM personnel to keep it switched off and locked during maintenance works.

7. The inverter standard shall be such that it should not allow solar power/battery power/DG power to extend to DISCOM's LT grid on failure of DISCOM's grid supply, irrespective of the LT connectivity options. The required inverter standard for three phase and single phase solar power are furnished in Annexure-III.
8. The inverter should be a sine wave inverter. Harmonic standards shall be as per IEEE 519. To avoid DC injection into the grid and to ensure other power quality parameters, the AC output of the inverter shall be connected through an Isolation Transformer to the grid.
9. Application for SPV connectivity shall be submitted to the concerned section officer alongwith registration charges applicable to that category of consumer specified in the relevant order of the Commission.
10. The net-metering connection agreement is furnished in Annexure-IV,

6. Applicability of Renewable Energy Certificates and RPO

Net-metering injection is not eligible for REC. The quantum of electricity consumed by an eligible consumer, who is not defined as an obligated entity from the rooftop solar system under net-metering arrangement shall qualify as deemed Renewable Purchase Obligation (RPO) for the distribution licensee.

7. Applicability of other charges

Third party owned systems installed within consumer premises may fall under the ambit of sale of electricity on open access, thus inviting charges related to wheeling and surcharge related to cross subsidy. Also net-metering based systems owing to their connectivity to grid and banking of electricity can also come under the purview of banking and wheeling charges etc. In order to promote the third party owned systems and avoid complexities around evaluation and monitoring of wheeling/banking/open access charges, the net metering rooftop solar arrangements are specifically exempted from these charges.

Sd/-
(Jayshree Raghuraman)
Secretary

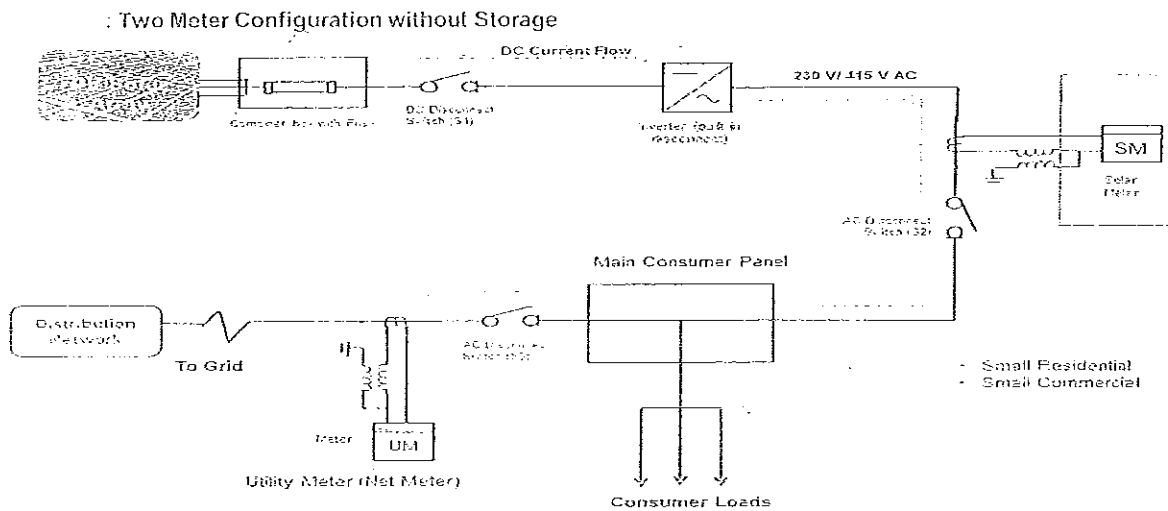
Annexure - I (A)

Net Metering – Meter Configuration options

The metering system for rooftop solar system, under net-metering arrangement, shall be as elaborated below which should be applicable till such time the Central Electricity Authority notifies the standards in this matter.

a) Two Meter Configuration without Storage

The metering protocol for 'Grid connected rooftop solar PV system without storage' and location of solar meter and consumer meter shall be in accordance with the schematic below



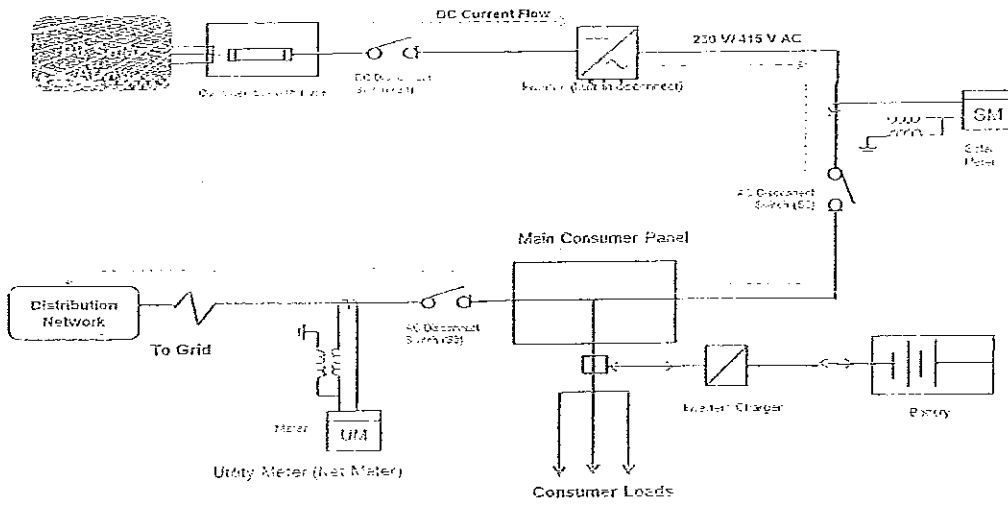
The utility meter (Net-meter) has to be bi-directional meter to register both import grid electricity amount as well as export solar electricity amount.

b) Two meter configuration with storage

The metering protocol for 'Grid connected rooftop solar PV system with storage' and location of Solar Meter (SM) and Utility Meter (UM) shall be in accordance with the schematic below,

Annexure - I (b)

Two meter configuration with storage



The utility meter (Net-meter) has to be bi-directional meter to register both import grid electricity amount as well as export solar electricity amount.

Annexure - II

TECHNICAL PARTICULARS OF SINGLE PHASE (5-20A)/THREE PHASE 10-60 OR 20-80 ENERGY METERS

1.0 FUNCTIONAL SPECIFICATION:

1.1	Applicable IS	IS 13779 or IS 14697 depending upon accuracy of meters.
1.2	Regulations	CEA Regulations on "Installation and Operation of Meters:" ,2006
1.3	Accuracy Class Index	1.0 or better up to 650 V
1.4	Voltage	415 Volt(P-P), +20% to -40% Vref, however the meter should withstand the maximum system voltage i.e. 440 volts continuously.
1.5	Display	a) LCD (Six digits),pin type
1.6	Power factor range	Zero lag -unity- zero lead
1.7	Display parameters	a) Display parameters : LCD test, KWH import, KWH export, MD in KW export, MD in KW import, Date & Time, AC current and voltages, power factor and meter cover open tamper with date and time (Cumulative KWH will be indicated continuously by default & other parameters through push-button) b) Display order shall be as per Annexure
1.8	Power Consumption	Less than 1 Watt & 4VA in Voltage circuit and 2 VA for Current circuit
1.9	Starting current.	0.2 % of Ib
1.10	Frequency	50 Hz with + / - 5% variation
1.11	Test Output Device	Flashing LED visible from the front
1.12	Billing data	a) Meter serial number, Date and time, KWH import, KWH export, MD in KW (both export and import), History of KWH import and export, & MD(both export & import) for last 6 billing cycles along with TOD readings. b) All these data shall be accessible for reading, recording and spot billing by downloading through optical port on MRI or Laptop computers at site.
1.13	MD Registration	a) Meter shall store MD in every 30 min. period along with date & time. At the end of every 30 min, new MD shall be compared with previous MD and store whichever is higher and the same shall be displayed. b) It should be possible to reset MD automatically at the defined date (or period) or through MRI.

1.14	Auto Reset of MD	c) Manual MD resetting using scalable push button is an optional.
1.15	TOD metering	Auto reset date for MD shall be indicated at the time of finalizing GIP and provision shall be made to change MD reset date through MRI even after installation of meter on site.
1.16	Security feature	Meter shall be capable of Time of use metering for KWH, and MD in KW with 8 time zones (programmable on site through CMRI)
1.17	Memory	Programmable facility to restrict the access to the information recorded at different security level such as read communication, communication write etc
1.18	Software &	Non volatile memory independent of battery backup, memory should be retained up to 10 year in case of power failure
1.19	communication compatibility	a) Optical port with RS 232 compatible to transfer the data locally through CMRI & remote through PSTN / Optical fiber / GSM / CDMA / RF / any other technology to the main computer. b) The Supplier shall supply Software required for CMRI & for the connectivity to AMR modules. The supplier shall also provide training for the use of software. The software should be compatible to Microsoft Windows systems (Windows 98 system). The software should have polling feature with optional selection of parameters to be downloaded for AMR application. c) Copy of operation manual shall be supplied. d) The data transfer (from meter to CMRI / AMR equipment) rate should be minimum 1200 bps. e) The Supplier shall provide meter reading protocols.
1.20	Climatic conditions	a) IS: 13779 or IS: 14697 for climatic conditions. b) The meter should function satisfactorily in India with high end temperature as 60°C and humidity up to 96%.
1.21	Meter Sealing	As per CEA Regulations, Supplier shall affix one Utility /buyer seal on side of Meter body as advised and record should be forwarded to Buyer.
1.22	Guarantee / Warranty	10 Years.
	Insulation	A meter shall withstand an insulation test of 4 KV and impulse test at 8 KV

1.23	Resistance of heat and fire	The terminal block and Meter case shall have safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them as per the relevant IS.
1.24	Battery	Lithium with guaranteed life of 15 Years
1.25	RTC & Micro controller	The accuracy of RTC shall be as per relevant IEC / IS standards
1.26	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm
1.27	Power ON/Off hrs:	Along with billing history parameters, meter shall log monthly ON/ Off hrs as history.
1.28	Tamper Logging	Last 200 events of Magnetic tamper; single wire tamper and top cover tamper shall be logged in memory along with Occurrence and restoration event data. Logic of defining tamper and OBIS code shall be agreed before supply of meter.
1.29	Protection against HV spark:	Meter shall continue to record energy or log the event, incase it is disturbed externally using a 35KV spark gun/ ignition coil.

2. TAMPER & ANTI-FRAUD DETECTION/EVIDENCE FEATURES

The meter shall not get affected by any remote control device & shall continue recording energy at least under any one or combinations of the following conditions:

2.1	I/C & O/G Interchanged	Meter should record forward energy
2.2	Phase & Neutral Interchanged	Meter should record forward energy
2.3	I/C Neutral Disconnected, O/G Neutral & Load Connected to Earth.	Meter should record forward energy
	I/C Neutral disconnected, O/G Neutral Connected To Earth Through Resistor & Load Connected To Earth.	Meter should record forward energy
2.5	I/C Neutral connected, O/G Neutral Connected To Earth Through Resistor & Load Connected To Earth.	Meter should record forward energy
2.6	I/C (Phase & Neutral) Interchanged, Load Connected To Earth.	Meter should record forward energy

2.7	I/C & O/G (Phase or Neutral) Disconnected, Load Connected to Earth	Meter should record forward energy
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3.0 INFLUENCE PARAMETERS

The meter shall work satisfactorily with guaranteed accuracy limit under the presence of the following influence quantities.

- a) External magnetic field – 0.5 Tesla.
- b) Electromagnetic field induction,
- c) Radio frequency interference,
- d) Vibration etc,
- e) Waveform 10% of 3rd harmonics,
- f) Voltage variation,
- g) Electro magnetic H.F. Field,
- h) D.C. immunity test,

4. DISPLAY SEQUENCE FOR THE PARAMETERS

A Default Display:

Cumulative KWH to be displayed continuously without decimal

B On-demand Display:

After using pushbutton the following parameters should be displayed.

1. LCD test
2. Date
3. Real Time
4. Current MD in kW
5. Current kW generated by solar system
5. Last month billing Date
6. Last month billing KWH reading
7. Last month billing Maximum Demand in KW
8. Last month billing Maximum Demand in KW occurrence Date
9. Last month billing Maximum Demand in KW occurrence Time
10. Instantaneous AC Current and Voltages
11. Power Factor
12. Display for Tamper
13. MD reset count

- 14. % THD of current harmonics R,Y,B
- 15. % THD of voltage harmonics R,Y,B
- 16. % THD above threshold value with date and time

Note: The meter display should return to Default Display mode (mentioned above) if the 'push button' is not operated for more than 6 seconds.

Annexure - III

Inverter Standards

Inverter should comply with IEC 61683/IS 61683 for efficiency and Measurements and should comply IEC 60068-2 (1,2,14,30) / Equivalent BIS Standard for environmental testing.

Inverter should supervise the grid condition continuously and in the event of grid failure (or) under voltage (or) over voltage, Solar System should be disconnected by the circuit Breaker / Auto switch provided in the inverter

Annexure - IV

Net Metering Connection Agreement

This Agreement is made and entered into at (location) _____ on this (date) _____ day of (month) _____ between

The Eligible Consumer _____ residing at _____ (address) _____ as first party

AND

_____ Distribution Licensee (herein after called as Discom) and having its registered office at _____ (address) _____ as second party of the agreement

Whereas, the eligible consumer has taken the responsibility to set up or facilitate the requisite Photovoltaic system and injection system into the Discom's grid

And whereas, the Discom agrees to benefit the eligible consumer for the electricity generated and as per conditions of this agreement and net metering regulations.

Both the party hereby agrees to as follows:

1 Eligibility

- 1.1 Eligible consumer is required to be aware, in advance, of the standards and conditions his system has to meet for being integrated into grid/distribution system.
- 1.2 Eligible consumer agrees that connection of Photovoltaic system to Discom's distribution system shall be bound by requirements of state Distribution Code and/or Discom's conditions of service. The grid shall continue to perform with specified reliability, security and quality as per the Central Electricity Authority (Grid Standard) Regulations 2010 as amended from time to time

2 Technical and Interconnection Requirements

- 2.1 Eligible consumer agrees that he has installed or will install, prior to connection of Photovoltaic system to Discom's distribution system, an isolation device (both automatic and inbuilt within inverter and external manual relays) and agrees for the Discom to have access to and operation of this, if required, for repair and maintenance of the distribution system
- 2.2 Eligible consumer agrees that in case of a power outage on Discom's system, photovoltaic system will shut down, unless special transfer and isolating capabilities have been installed on photovoltaic system.
- 2.3 All the equipment connected to distribution system must be complaint with relevant international (IEEE/IEC) or Indian standards (BIS) and installations of electrical equipment must comply with Indian Electricity rules, 1956 and Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations, 2010.
- 2.4 Eligible consumer agrees that Discom will specify the interface/inter-connection point and metering point
- 2.5 Eligible consumer agrees to adhere to following power quality measures as per International or Indian standards and/or other such measures provided by Commission/Discom.
 - a. **Harmonic current:** Harmonic current injections from a generating station shall not exceed the limits specified in IEEE 519.
 - b. **Synchronization:** Photovoltaic system must be equipped with a grid frequency synchronization device.

- c. **Voltage:** The voltage-operating window should minimise nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. Beyond a clearing time of 2 seconds, the Photovoltaic system must isolate itself from the grid.
- d. **Flicker:** Operation of Photovoltaic system shouldn't cause voltage flicker in excess of the limits stated in the relevant sections of IEC standards or other equivalent Indian standards if any.
- e. **Frequency:** When the Distribution system frequency deviates outside the specified conditions (50.5 Hz on upper side and 47.5 Hz on lower side), the Photovoltaic system shouldn't energize the grid and should shift to island mode.
- f. **DC Injection:** Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point or 1% of rated inverter output current into distribution system under any operating conditions.
- g. **Power Factor:** While the output of the inverter is greater than 50%, a lagging power factor of greater than 0.9 should operate.
- h. **Islanding and Disconnection:** The Photovoltaic system in the event of voltage or frequency variations must island/disconnect itself within IEC standard on stipulated period.
- i. **Overload and Overheat:** The inverter should have the facility to automatically switch off in case of overload or overheating and should restart when normal conditions are restored.
- j. **Paralleling device:** Paralleling device of Photovoltaic system shall be capable of withstanding 220% of the nominal voltage at the interconnection point.

2.6 Eligible consumer agrees to furnish all the data such as voltage, frequency, and breaker, isolator position in his system, as and when required by the Discom. He may also try to provide facilities for online transfer of the real time operational data.

3. Safety

- 3.1 Eligible consumer shall comply with the Central Electricity Authority (Measures Relating to Safety and Electricity Supply) Regulations 2010.
- 3.2 Eligible consumer agrees that the design, installation, maintenance and operation of the photovoltaic system are performed in a manner conducive to the safety of the photovoltaic system as well as the Discom's distribution system.
- 3.3 Due to Discom's obligation to maintain a safe and reliable distribution system, eligible consumer agrees that if it is determined by Discom that eligible consumer's photovoltaic system either causes damage to and/or produces adverse effects affecting other distribution systems' consumers or Discom's assets, eligible consumer will have to disconnect photovoltaic system immediately from the distribution system upon direction from the Discom and correct the problem at his own expense prior to a reconnection.

4. Clearances and Approvals

- 4.1 The eligible consumer agrees to attain all the necessary approvals and clearances (environmental and grid connected related) before connecting the photovoltaic system to the distribution system.

5. Access and Disconnection

- 5.1 Discom shall have access to metering equipment and disconnecting means of photovoltaic system, both automatic and manual, at all times.
- 5.2 In emergency or outage situation, where there is no access to a disconnecting means, both automatic and manual, such as a switch or breaker, Discom may disconnect service to the premise.

6. Liabilities

- 6.1 Eligible consumer and Discom will indemnify each other for damages or adverse effects from either party's negligence or intentional misconduct in the connection and operation of photovoltaic system or Discom's distribution system.
- 6.2 Discom and eligible consumer will not be liable to each other for any loss of profits or revenues, business interruption losses, loss of contract or loss of goodwill, or for indirect, consequential, incidental or special damages, including, but not limited to, punitive or exemplary damages. Whether any of the said liability, loss or damages arise in contract, or otherwise.
- 6.3 Discom shall not be liable for delivery or realization by eligible consumer for any fiscal or other incentive provided by the central government

7. Commercial Settlement

- 7.1 All the commercial settlement under this agreement shall follow the Net metering regulations of __ Electricity Regulatory Commission.

8. Connection Costs

- 8.1 The eligible consumer shall bare all costs related to setting up of photovoltaic system including metering and interconnection costs. The eligible consumer agrees to pay the actual cost of modifications and upgrades to the distribution facilities required to connect photovoltaic system in case it is required
- 8.2 Cost for interconnection equipment including the isolators, meters etc. are also to be borne by the eligible consumer

9. Termination

- 9.1 The eligible consumer can terminate agreement at any time by providing Discom with 90 days prior notice
- 9.2 Discom has the right to terminate Agreement on 30 days prior written notice, if eligible consumer breaches a term of this Agreement and does not remedy the breach within 30 days of receiving written notice from Discom of the breach.
- 9.3 Eligible consumer agrees that upon termination of this Agreement, he must disconnect the photovoltaic system from Discom's distribution system in a timely manner and to Discom's satisfaction.

In the witness, where of Mr. _____ for an on behalf of _____ (Eligible consumer) and Mr. _____ for and on behalf of _____ (Discom) agree to this agreement

